Journal of Prime Research in Mathematics Vol. **15***(2019)*, 5-20

ADVANCED ALGORITHM FOR SOLVING A TRANSPORTATION PROBLEM WITH FIVE INDICATORS AND FIXED COST

BENOUMELAZ FAROUK[1], ABED SAMIRA[2], KHELIL NACER[3], REBIAI BELGACEM[4], KAMAL HOUAM[5]

Abstract. In this paper, we studied an advanced algorithm for obtaining the best solution to a transportation problem a fixed-charge with five indicators (AATPI5FC) , the procedure itself is very quick; the proposed method solves FCTPI5 by analyze the problem into partial subsections, solution algorithm is coupling between our technique and simplex algorithm (the technique on the fifth index to guarantee improved service), which is novel and can be useful to researchers solved these problems, the advantages of the proposed advanced algorithm are discussed on the existing methods in the context of the application model, the results showed that the proposed advanced algorithm is simple ,accurate and more computational methods found in literature.

AMS. Key words : transportation model, multi-index, fixed cost, operation research, coupling, simulation.
AMS SUBJECT : **Primary** :90C05, 90C08, 90C11 ,90C90.

1. Introduction

Transport problems have different applications in the field of supply to reduce costs, methods of transport in working life have unknown and uncontrollable effects. In this paper, we proposed a new advanced algorithm for solving a transportation problems, the algorithm is coupling between my technique and simplex algorithm (the technique on the fifth index to guarantee improved service).

Linear programming is still dependent on many decision-makers because it provides management solutions, one goal is to maximize profits and reduce

[1]University Batna 01. Email: fbenoumelaz@yahoo.fr 1
[2]University Batna 02. Email: abed.samira@yahoo.fr 2
[3]University Biskra. khelilin@yahoo.fr 3
[4]University Tebassa Rebiaib@gmail.com 4
[5]University Tebassa labolamis@gmail.com 5.

costs because of their good results in management and planning, the study has one such goal; but in transport models it plays an important role in services to reduce costs and improving public services.

Such fixed transportation costs was proposed by[17]; in[3]we solved the use of linear programming in solving the transportation problem; in[4]we studied scheduling problem transportation with five indicators, in[2]Progress in the dual simplex algorithm for solving large scale LP problems: techniques for a fast and stable implementation, in[14]wright numerical optimization, second edition his outlines the paper. In the theoretical section of the network scheduling, in the application section we determined the mathematical model of the distribution problem, the last section we proposed a new algorithm for solve the problem and get the distribution of goods at the lowest cost.

2. STATE OF THE ART

The first transport problem was in 1941 by Hitchcock; it was introduced in 1949 by Kantorovich, Gavourin. Then G.B. Danzig Ozers decided another method of transport problem, depending on the simple method, In 1958 Gilesal introduced a method using the simple-double algorithm and 1963, Kon provides a method of solving the problem of employment and the evolution of the idea of mathematics in 1931. Despite the potential or proposed method in the middle of the 20th century, the most widely used research and teaching[16] ... However, it provides little opportunity application in reality. The larger is verified m = 40, n = 40 [6]for only find the "right" initial solution, are several methods. Indeed, next to the methods classics (corner of Northeast, Vogel ...) two new methods are proposed: the DOR method [6] and an approximate method for the problem[18], following this problem, the extension of the potential method is proposed to solve the transport problem in two capacity indices (PT2IC),its extension being a class PT2IC with terminals on conditions for the availability to the origins and requirements destinations, has applications in network telecommunication, production-distribution system automated freight capacity where the resource is limited, in[7]another extension of the problem Hitchcock is to solve problems constraints exclusion (TPESC), the model is based on several practical problems of distribution and storage. As in the traditional problem of goods must be shipped and stored in set warehouses. However, a warehouse cannot be automated to simultaneously receive goods in the same facility due to damage or damage, for example the materials dangerous, such as explosives, flammable, oxidizing elements should be separated each other to eliminate the possibility of damage[19].

In the classic problems, the constraints are mandatory, the problem with both indices been extended with the coefficients of fuzzy cost, supply and blurred and entire application[5], they used an exact method to solve this problem in two steps, first the problem is into a different problem; then, they offered a method to solve the solving several Hitchcock problems, for a simple model with deals and unclear demands, the treated size is very small: m = 2; n = 3. Thus, several algorithms are proposed to solve transportation problems in a Blurred environment but in all these, the parameters are represented by normal fuzzy numbers, by focusing on this direction, a new approach is the ranking function proposed to solve a particular type of transport problem blur assuming only the cost is uncertain but he has no uncertainty on supply and demand so, these transport costs are represented by numbers fuzzy generalized trapezoidal[1].

In many real cases, transport systems must meet both several objectives, according to this extension; multi-objectives were developed problems : Fuzzy coefficients "possibility " function objective ,[9]interval settings[8]. To solve it uses programming, size of models shown is very small with the index of criteria k = 2; the original index m= 2, the indexer of destination n= 3 Hussein for the problem ,a problem provides a set complete solutions whose effectiveness is related to a probability 2 [0:1] and k = 2 ,m= 3,n = 4 for Das problem.

By increasing the number of indices, the problem of transport three indices (PT3I) is developed and solved by an extension of the potential method. using a cuboid: a stop represents the origin o_i, (i =1 ... m), the other is the destination d_j (j = 1 ... n) and the third stop is the type of goods Sk or type of transportation h_k (k = 1 ...: p). With the use of the parallelepiped, With the use of the parallelepiped, we find that (PT3I) constraints are represented as a series of rectangles which represents the constraints two indexes when a variable is kept, the other are changed and have been superimposed on each other, thus the transactions in a cuboid, for example; looking for the first solution or the development of a cycle in a parallelepiped, is not easy. Her extensions are less varied: an approximate method, based on the addition of additional settings to create a new problem deterministic, is proposed to solve the problem in between, about the vagueness problem, Simple approximate method by transforming it into range[10]and an evolutionary algorithm based on parametric approach are presented[11]in addition, an algorithm improved genetics, to solve the problem multi-objective with fuzzy numbers is proposed, numerical example is solved with m = n = p = 3 and number of criteria k = 3[12]. Simultaneously, he continue to generalize the problem transportation, in a general problem in n indices, there is (N-1) issues to n indices (TNPI) according to the summation constraints on (n-1) indices, so different from the previous reflection, P. X. Ninh does not use the n-dimensional super box to solve it, it offers an accurate method on the plan, extension potential, which coordinates the resolution of primal problem and the dual; however, this result does not cover the solution of all the (n-1) problems particular because it found only a necessary condition and a sufficient condition for the problem has a solution[15]. In general, most no problems indexes only value in terms theoretical therefore, Ninh chose to solve a case with the summation of (n-1) indices brings advantage of economic significance[15]; this is by[13], my contribution in the mathematical model is formulated as follows:

Identify variables $x_{ijklt} \geq 0, i = 1, ...m, j = 1...n, k = 1...q, l = 1...p\ ,t = 1...r$; for;

$$minZ = min \sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} \sum_{t=1}^{r} c_{ijklt}x_{ijklt} + \sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} \sum_{t=1}^{r} \theta_{ijklt}y_{ijklt} \quad (1)$$

Investigation the constraint:

$$\sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} \sum_{t=1}^{r} x_{ijklt} = \alpha_i i = 1....n \quad (2)$$

$$\sum_{i=1}^{n} \sum_{k=1}^{m} \sum_{l=1}^{p} \sum_{t=1}^{r} x_{ijklt} = \beta_j ; j = 1...m \quad (3)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{l=1}^{p} \sum_{t=1}^{r} x_{ijklt} = \gamma_k ; k = 1...q \quad (4)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{t=1}^{r} x_{ijklt} = \delta_l ; l = 1...p \quad (5)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} x_{ijklt} = \lambda_t ; t = 1...r \quad (6)$$

These constraints include the original offer; demand to destination j, the amount of product and the k quantity transported by the truck.

2.1. **STATEMENT OF THE PROBLEM.** A two- indicator the model with supply and demand; three indicators: supply, demand, goods or trucks, the fifth indicator is the period, In these patterns, we impose restrictions on all indicators. The aim is to propose the transfer of products and to verify all restrictions at the lowest possible cost.

2.2. **DECISION VARIABLES.** -Z represent the function objective (transport cost)

- adaptation the problem in the form linear programming model (LP)
- the index i denotes the centers,$(i = 1; ...; m)$
- the index j denotes the stores, $(j = 1; ...; n)$
- the index k denotes the trucks $(k = 1; ...; q)$
- the index l denotes the type dates $(l = 1; ...; p)$
-the index t denotes the period $(t = 1; ...; r)$
- x_{ijklt} represent the goods of type k; moved from the center i to the warehouse j in the l lorry in period t

-c_{ijklt} the cost of transporting the goods of type k; moved from the center i to the warehouse j in the l lorry in period t.

-θ_{ijklt} fixed cost on the type of truck (Premium a warded for the driver).

-y_{ijklt}=0,1 $\forall$ i;j,k,l ,y_{ijklt}= $\left.\begin{matrix} 1\ If\ the\ truck\ of\ the\ type\ 1 \\ 0\ If\ it\ does\ not \end{matrix}\right\}$

$$minZ = min \sum_{i=1}^{n} \left\{ \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} \sum_{t=1}^{r} c_{ijklt} x_{ijklt} \right. + \sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} \sum_{t=1}^{r} \theta_{ijklt} y_{ijklt} \quad (7)$$

and check constraints:

$$\sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} \sum_{t=1}^{r} x_{ijklt} = \alpha_i, i = 1....n \quad (8)$$

$$\sum_{i=1}^{n} \sum_{k=1}^{m} \sum_{l=1}^{p} \sum_{t=1}^{r} x_{ijklt} = \beta_j; j = 1...m \quad (9)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{l=1}^{p} \sum_{t=1}^{r} x_{ijklt} = \gamma_k; k = 1...q \quad (10)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{t=1}^{r} x_{ijklt} = \delta_l; l = 1...p \quad (11)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} x_{ijklt} = \lambda_t; t = 1...r \quad (12)$$

3. Application on the model

I chose the dates transfer model in Algeria it is a perfect as follows; these constraints include the original offer, demand to destination j; the amount of product and the k quantity transported by the truck; transportation model (five indicators with addition charge);i=1;...;4, j=1;...;3, k=1;...;2, l=1;...;2 ,t =1...2

Numbering the centers Ouargla, Biskra; M'sila; Elaalma are the following 1;2;3;4; respectively.

Numbering stores M'sila; El aalma; Skikda are the following 1;2;3 respectively.

1 is numbre of the truck (15 t) ;2 is numbre of the truck (5.5t) and numbre 1 of the quality is good type; 2 is meidium.

schedule(1) product transferred between the stores (in tons).

Good quality t_1

Medium quality t_2

	Msila	Msila	Elealma	Elealma
Period	P1	P 2	P 1	P2
Ouargla; {(*Good quality t*1) (*Medium quality t* 2)}	30.000 100.000	10.000 55.000	30.000 100.000	10.000 55.000
Biskra; {(*Good quality t*1) (*Medium quality t* 2)}	200.000 200.000	50.000 50.000	200.000 200.000	50.000 50.000
M'sila; {(*Good quality t*1) (*Medium quality t* 2)}	....	......	....	....
El ealma {(*Good quality t*1) (*Medium quality t* 2)}	....	......	....	......

	Skikda	Skikda
Periods	P t_1	P t_2
Ouargla{(*Good quality t*1) (*Medium quality t* 2)}	....	0000
Biskra{(*Good quality t*1) (*Medium quality t* 2)}	.....	.....
Msila{(*Good quality t*1) (*Medium quality t* 2)}	100.000 40.000	10860 3620
Elealma{(*Good quality t*1) (*Medium quality t* 2)}	100.000 40.000	19620 6540

3.1. **The definition of variables.**

- x_{ijklt} represent the goods of type k moved from the center i to the warehousej ; in the l lorry in period t

-c_{ijklt} represent the cost of transporting the goods of type k moved from the center i to the warehousej. In the l trich in period t.

-θ_{ijklt} represent fixed cost on the type of truck (premium awarded for the driver)

$$y_{ijklt}=0,1\ \forall\ i; j; k, l, t;\ y_{ijklt} = \begin{cases} 1\ If\ the\ truck\ of\ the\ type\ 1 \\ 0\ If\ it\ does\ not \end{cases}$$

number trips approval for l=2

$$f_j = \sum_{i=1}^{n} \sum_{t=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} x_{iklt} \geq 3b_j/(4)$$

the requirement to improve services.

$$\begin{cases} l = 1\ si\ \sum_{j=1}^{m} \sum_{i=1}^{n} \sum_{l=1}^{p} \sum_{k=1}^{q} x_{iklt} \leq 3b_j/(4*15) \\ l = 2\ If\ it\ does\ not \end{cases}$$

fixed cost requirement to improve services.

Improve drivers' services to achieve the goals contract between the companies.

θ_{ijklt}= 1000* f_j; $\forall$i = 1; ::4; k = 1; 2; l = 1; 2

look for the minimum value Z (reduce transportation costs)

$Z=33600x_{11111}+33600x_{11112}+33600x_{11211}+33600x_{11212}+11200x_{11121}+11200x_{11122}+11200x_{11221}+1200x_{11222}+11220x_{21111}+11220x_{21112}+11220x_{21211}+11220x_{21212}+11220x_{21121}+11220x_{21122}+3740x_{21221}+3740x_{21222}+34800x_{12111}+34800x_{12112}+34800x_{12211}+34800x_{12212}+11600x_{12121}+11600x_{12122}+11600x_{12221}+11600x_{12222}+14700x_{22111}+14700x_{22112}+14700x_{22211}+14700x_{22212}+4900x_{22121}+4900x_{22122}+4900x_{22221}+4900x_{22222}+10860x_{33111}+10860x_{33112}+10860x_{33211}+10860x_{33212}+3620x_{33121}+3620x_{33122}+3620x_{33221}+3620x_{33222}+19620x_{43111}+19620x_{43112}+19620x_{43211}+19620x_{43212}+6540x_{43121}+6540x_{43122}+6540x_{43221}+6540x_{43222}+\sum_{i=1}^{4}\sum_{j=1}^{3}\sum_{k=1}^{2}\sum_{l=1}^{2}\sum_{t=1}^{2}\theta_{ijklt}y_{klt}^{ij}$

$\min Z=\min(33600x_{11111}+33600x_{11112}+33600x_{11211}+33600x_{11212}+11200x_{11121}+11200x_{11122}+11200x_{11221}+1200x_{11222}+11220x_{21111}+11220x_{21112}+11220x_{21211}+11220x_{21212}+11220x_{21121}+11220x_{21122}+3740x_{21221}+3740x_{21222}+34800x_{12111}+34800x_{12112}+34800x_{12211}+34800x_{12212}+11600x_{12121}+11600x_{12122}+11600x_{12221}+11600x_{12222}+14700x_{22111}+14700x_{22112}+14700x_{22211}+14700x_{22212}+4900x_{22121}+4900x_{22122}+4900x_{22221}+4900x_{22222}+10860x_{33111}+10860x_{33112}+10860x_{33211}+10860x_{33212}+3620x_{33121}+3620x_{33122}+3620x_{33221}+3620x_{33222}+19620x_{43111}+19620x_{43112}+19620x_{43211}+19620x_{43212}+6540x_{43121}+6540x_{43122}+6540x_{43221}+6540x_{43222}+\sum_{i=1}^{4}\sum_{j=1}^{3}\sum_{k=1}^{2}\sum_{l=1}^{2}\sum_{t=1}^{2}\theta_{ijklt}y_{klt}^{ij}$

Subject to:

$x_{11111}+x_{11121} + x_{12111} + x_{12221} = 130.000;$

x_{11112}+x_{11122} + x_{12112} + x_{12122} =50.000
x_{21111}+x_{21211}+x_{22111}+x_{22121} = 40.000;
x_{21112}+x_{21212}+x_{22112}+x_{22122} = 100.000
x_{11111}+x_{12111} = 30.000 ;x_{11112}+x_{12112}= 10.000
x_{12111} + x_{12121} = 30.000; x_{12112} + x_{12122} = 10.000
x_{33111}+x_{43111}= 100.000; x_{33112}+x_{43112} = 50.000
x_{21111}+x_{21111} = 200.000; x_{21112}+x_{21112} = 50.000
x_{21121}+x_{21221} = 200.000; x2112+x_{21222} = 50.000
x_{11111} + x_{11121} + x_{21111} + x_{21121} - x_{33111} - x_{33121} = 260.000;
x_{11112} + x_{11122} + x_{21112} + x_{21122} - x_{33112} - x_{33122} = 40.000
x_{11121} + x_{21121} - x_{43121} = 130.000; x_{11122} + x_{21122} - x_{34122} = 10.000
x_{11111} + x_{21111} - x_{33111} = 130.000;x_{11112} + x_{21112} - x_{33112} = 10.000
x_{11211} + x_{21211} - x_{33211} = 260.000;x_{11212} + x_{21212} - x_{33212} = 95.000
x_{11221} + x_{21221} - x_{33221} = 260.000;x_{11222} + x_{21222} - x_{33222} = 95.000
x_{12111} + x_{22111} - x_{43111} = 130.000;x_{12112} + x_{22112} - x_{43112} = 10:000
x_{12121} + x_{22121} - x_{43121} = 130.000;x_{12122} + x_{22122} - x_{43122}= 10.000
x_{11211}+ x_{11121} + x_{21211} + x_{21121}- x_{33211} - x_{33221} = 205:000
x_{12111} + x_{12121} + x_{22111} + x_{22121} - x_{43111} - x_{43121} = 130.000;
x_{12112} + x_{12122} + x_{22112} + x_{22122} - x_{43112} - x_{43122} = 10.000
x_{11111}+x_{11211}+x_{11211}+x_{11221} = 130.000;x_{11112}+x_{11212}+x_{11212}+x_{11222} =65.000
x_{11111} + x_{11121} = 30.000;x_{11112} + x_{11122} = 10.000
x_{11211} + x_{11221} = 100.000 ; x_{11212} + x_{11222}= 55.000
x_{21111} + x_{21121} = 200.000; x_{21112} + x_{21122} =50.000
x_{21211} + x_{21221} = 200.000; x_{21212} + x_{21222} = 50.000
x_{21111}+x_{21121}+x_{21211}+x_{21221} =400+x_{21112}+x_{21122}+x_{21212}+x_{21222} = 100
x_{22211} + x_{22221} = 200.000; x_{22212} + x_{22222} = 50.000
x_{22111} + x_{22121} = 200.000; x_{22112} + x_{22122} = 50.000
x_{43111} + x_{43121} = 100.000; x_{43112} + x_{43122} = 50.000
x_{43211} + x_{43221} = 40.000; x_{43212} + x_{43222}= 10.000
x_{33111} + x_{33121} = 100.000; x_{33112} + x_{33122} = 50.000
x_{33211} + x_{33221} = 40.000; x_{33212} + x_{33222} = 10.000
x_{33111} +x_{33121} +x_{33211} +x_{33221}+x_{43111} +x_{43121} +x_{43211} +x_{43221} = 140.000
x_{33112} +x_{33122} +x_{33212} +x_{33222} +x_{43112} +x_{43122} +x_{43212} +x_{43222} = 60.000
restrictions for improve service.
x_{11111} + x_{11211} + x_{21111} + x_{21211} $\leq$530.000/4
x_{11112} + x_{11212} + x_{21112} + x_{21212} $\leq$165.000/4
x_{12111}+ x_{11211} + x_{22111}+ x_{22211} $\leq$530.000/4
x_{12112}+ x_{11212} + x_{22112} + x_{22212} $\leq$165.000/4
x_{33111} + x_{33211} + x_{43111} + x_{43211} $\leq$140.000/4
x_{33112} + x_{33212} + x_{43112} + x_{43212} $\leq$ 60.000/4
0 $\leq x_{11111}$ $\leq$300.000 ; 0$\leq$ x_{11112} $\leq$10:000
0 $\leq x_{11211}$ $\leq$ 100:000; 0 $\leq x_{11212}$ $\leq$ 55:000

0 $\leq x_{11121} \leq$ 30:000; 0$\leq x_{11122} \leq$10:000 0
$\leq x_{11221} \leq$100000 ;0 $\leq x_{11222} \leq$55:000
0 $\leq x_{21111} \leq$200000 ;0$\leq x_{21112} \leq$50:000
0 $\leq x_{21211} \leq$200.000 ;0$\leq x_{21212} \leq$50:000
0 $\leq x_{21121} \leq$200:000; 0$\leq x_{21122} \leq$5:000
0 $\leq x_{21221} \leq$200:000; 0$\leq x_{21222} \leq$50:000
0$\leq x_{12111} \leq$ 30:000 ;0 $\leq x_{12112} \leq$ 10:000 0
$\leq x_{12211} \leq$100:000; 0$\leq x_{12212} \leq$55.000
0 $\leq x_{12121} \leq$300.000; 0$\leq x_{12122} \leq$10.000
0 $\leq x_{12221} \leq$100.000; 0$\leq x_{12222} \leq$ 55.000
0 $\leq x_{22111} \leq$200.000; 0$\leq x_{22112} \leq$50.000
0 $\leq x_{22211} \leq$200:000; 0$\leq x_{22212} \leq$50.000
0$\leq x_{22121} \leq$200:000; 0 $\leq x_{2212} \leq$50.000
0$\leq x_{22221} \leq$200:000; 0 $\leq x_{22221} \leq$50:000
0 $\leq x_{33111} \leq$100:000; 0 $\leq x_{33112} \leq$50.000
0 $\leq x_{33121} \leq$100:000; 0$\leq x_{33122} \leq$ 50.00
0 $\leq x_{33221} \leq$ 40:000; 0$\leq x_{33222} \leq$ 10.000
0$\leq x_{33211} \leq$40:000; 0$\leq x_{33212} \leq$10.000
0 $\leq x_{43111} \leq$40:000; 0 $\leq x_{43112} \leq$10.000
0 $\leq x_{43211} \leq$ 40:000 ;0 $\leq x_{43212} \leq$ 10.000
0 $\leq x_{43121} \leq$ 100:000; 0$\leq x_{43122} \leq$ 50.000
0 $\leq x_{43221} \leq$ 40:000; 0$\leq x_{43222} \leq$ 10.000

4. Algorithm

Way Algorithm in two phases
to determine the θ_j, we propose the following algorithm:

Algorithm 1

---

require: size f_j, real m,n p,q,t
ensure: θ_j, real
1: Initialize: $\theta_j = 0$
2:for j=1; 2; 3; : : : ; do
3: for i=1; 2; 3; : : : ; do
4: for k=1; 2; 3; : : : ; do
5: for l=1; 2; 3; : : : ; do
6: Initialize: $f_j = f_j + \sum_{i=1}^{n} \sum_{t=1}^{l} \sum_{k=1}^{q} \sum_{l=1}^{p} x_{iklt}$
7: if $f_j \leq 3b_j/(4*15)$
l=1

8 $:\theta_j = 1000 \sum_{i=1}^{n} \sum_{t=1}^{l} \sum_{k=1}^{q} \sum_{l=1}^{p} x_{iklt}/15$
9: end if
10: end for
11: end for
12:end for

Algorithm 2 Calculate the ideal cost min Z

Require: size m n, matrix A B C
Ensure: average absolute error, time taken to execute program
1:Initialize A ,B C Aeq Beq l u f
2:start timer ;
3 :Let f=0
4 : while l=2 do
5: for j=1;2:::::: do
6: $\theta = \sum_{j=1}^{m} \theta_j$. ....Algorithm 1
7: x = linprog(f,A,b,Aeq,beq,lb,ub); .... MATLAB built-in function
8: minZ=f+θ
9: end for
10: end wile
11: end timer ;
12: display resultats

Explanation of the algorithm
write the objective function vector and vector of integer variables.
f=input('input the vector f');
c=input('input le vecteur C');
write the linear inequality constraints.
A=input('input the matrix A');
b = input ('input the vector b');
write the linear equality constraints
Aeq=input('input the matrix Aeq');
beq = input ('input the vector beq');
Write the bound constraints
lb= input ('input the vector lb');
ub= input ('input the vector ub');
The first phase

the constraint is placed on the type of truck

$$\begin{cases} l = 1 \ si \ \sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{q} \sum_{l=1}^{p} x_{ijklt} \leq 3b_j/(4*15) \\ l = 2 \ If \ it \ doesnot \end{cases}$$

The second phase

Call linprog.

x = linprog(f,A,b,Aeq,beq,lb,ub);

linprog stopped at the root node because the objective value is within a gap tolerance of the optimal value,

end

Exiting: One or more of the residuals, duality gap, or total relative error

has grown 100000 times greater than its minimum value so far:

the primal appears to be infeasible (and the dual unbounded).

(the dual residual ¡ TolFun=1.00e-008.)

x =

1.0e+004 *

x_{11111}=5.4958

x_{11112}=3.1711

x_{11211}=1.6154

x_{11212}=1.9227

x_{11121}=7.8417

x_{11122}=5.5030

x_{11221}=0.0000

x_{11222}=1.0969

x_{21111}=6.7036

x_{21112}=2.1321

x_{21211}=0.4835

x_{21212}=0.9127

x_{21121}=2.9615

x_{21122}=0

x_{21221}=3.1199

x_{21222}=0

x_{12111}=0.5089

x_{12112}=4.3684

x_{12211}=7.0658

x_{12212}=0.2702

x_{12121}=0.9467

x_{12122}=1.3400

x_{12221}=1.5858

x_{12222}=1.7323

x_{22111}=6.8046

x_{22112}=2.2356
x_{22211} =0.2528
x_{22212}=1.7777
x_{22121}=0.0001
x_{22122}=4.1185
x_{22221}=2.3528
x_{22222}=0
x_{33111}=3.8955
x_{33112}=3.6766
x_{33211}=3.8444
x_{33212}=2.9756
x_{33121}=2.5062
x_{33122}=2.8915
x_{33221}=4.2856
x_{33222}=2.0564
x_{43111}=3.5229
x_{43112}=2.8225
x_{43211}=1.0715
x_{43212}=2.2397
x_{43121}=3.5604
x_{43122}=2.4812
x_{43221} =0.6494
x_{43222}=1.7231

5. *Main Results and Discussions*

All computations was performed on Intel(R) Core(TM)2 Duo, 3.16 GHz CPU, 4.00 GB memory and 32-bit Operating System. As for the software, all computations are performed using MATLAB R2011a Here, the performance metrics is analyzed by examining the execution time, the memory cost and the accuracy of algorithm. The execution time is the total time taken for our method to converge which is measured at the MATLAB software, the memory cost is mainly determined by the total memory cost of our program which is measured at the computers task manager.

Better planning In the following schedule.

	Type	Truck	Period	M'sila N01
Biskra N^{01}	$(Good\ quality\ t1)$ $(Medium\ quality\ t\ 2)$	$TruckN^{01}(15.t)$ $TruckN^{02}(5.5t)$	$p(1)$ $p(2)$	$x_{11111} = 5.4958$ $x_{11112} = 3.1711$ $x_{11112} = 3.1711$ $x_{11212} = 1.9227$ $x_{11121} = 7.8417$ $x_{11122} = 5.5030$ $x_{11221} = 0.0000$ $x_{11222} = 1.0969$
ourgla N^{02}	$(Good\ quality\ t1)$ $(Medium\ quality\ t\ 2)$	$TruckN^{01}(15.t)$ $TruckN^{02}(5.5t)$	$p(1)$ $p(2)$	$x_{21111} = 6.7036$ $x_{21112} = 2.1321$ $x_{21211} = 0.4835$ $x_{21212} = 0.9127$ $x_{21121} = 2.9615$ $x_{21122} = 0$ $x_{21221} = 3.1199$ $x_{21222} = 0,$
M'sila N^{03}	$(Good\ quality\ t1)$ $(Medium\ quality\ t\ 2)$	$TruckN^{01}(15.t)$ $TruckN^{02}(5.5t)$	$p(1)$ $p(2)$	
El ealma N^{04}	$(Good\ quality\ t1)$ $(Medium\ quality\ t\ 2)$	$TruckN^{01}(15.t)$ $TruckN^{02}(5.5t)$	$p(1)$ $p(2)$	

	El ealma N^{02}	Skikda N^{03}
Biskra N^{01}	$x_{12111} = 0.5089$ $x_{12112} = 4.3684$ $x_{12212} = 0.2702$ $x_{12121} = 0.9467$ $x_{12211} = 7.0658$ $x_{12122} = 1.3400$ $x_{12221} = 1.5858$ $x_{12222} = 1.7323$,	....
ourgla N^{02}	$x_{22111} = 6.8046$ $x_{22112} = 2.2356$ $x_{22211} = 0.2528$ $x_{22212} = 1.777$ $x_{22121} = 0.0001$ $x_{22122} = 4.1185$ $x_{22221} = 2.3528$ $x_{22222} = 0$	......
M'sila N^{03}	....	$x_{33111} = 3.8955$ $x_{33112} = 3.6766$ $x_{33211} = 3.8444$ $x_{33212} = 2.9756$ $x_{33121} = 2.5062$ $x_{33122} = 2.8915$ $x_{33221} = 4.2856$ $x_{33222} = 2.0564$
El ealma N^{04}	....	$x_{43111} = 3.5229$ $x_{43112} = 2.8225$ $x_{43211} = 1.0715$ $x_{43212} = 2.2397$ $x_{43121} = 3.5604$ $x_{43122} = 2.4812$ $x_{43221} = 0.6494$ $x_{43222} = 1.7231$

6. Conclusions

In this article; we proposed an improved algorithm we do a coupling between our technique and a classical method that was introduced to solve the transport problem with five indicators and fixed charge (PT5ICF), the technical algorithm is implemented to provide the initial set, and search the fifth indicator followed by the local search method to improve the quality of the solutions, we concluded that the integration of the first technique and the local search technique had improved the quality of the solution to prevent a very large many solutions are updated frequently in the presence of new solutions.

The advantages of the proposed advanced algorithm are discussed about the existing methods in the context of the application model, the results showed that the proposed algorithm is simpler and more computational than the methods found in the literature.

The proposed mathematical model is successful; effective and makes a profit for the company and the algorithm has good results, there are several distribution plans, the planning we have is the best.

References

[1] A .Kaur, . And A. Kumar, 2011. A new approach for solving fuzzy transportation problem using generalized trapezoidal fuzzy numbers. Applied Soft Computing. Online 31 October 2011..

[2] Andersen, E. D., and K. D. Andersen.Presolving in linear programming. Math. Programming 71, 1995, pp. 221–245.

[3] [Benoumelaz Farouk, Abed Samira],The use of linear programming in solving the transportation problem may 2016 volume 7 issue 5, pp1581-1586.

[4][Benoumelaz Farouk, Abed Samira .transportation problem with five andicatours Advanced Modeling and Optimization, 2017,pp.233-251.

[5] Chanas, S. and D. Kuchta, 1998. Fuzzy integer transportation problem. Fuzzy Sets and Systems, Vol 98(3), p. 291-298.

[6] Dubeau, F. and M. Guèye., 2008. Une nouvelle méthode d'initialisation pour le problème de transport. Rairo Operations Research, Vol 42(1), 389-400.

[7]Dahiya, K. And V. Verma, 2007. Capacitated transportation problem with bounds on RIM conditions. European Journal of Operational Research, Vol 178(3),p. 718-737.

[8] Das, S.K., A. Goswani and A. Alam., 1999. Multiobjective transportation problem with interval cost, source and destination parameters. European Journal of Operational Research, Vol 117(1), 100-112.

[9]Hussein, M.L., 1998. Complete solutions of multiple objective transportation problems with possibilistic coefficients. Fuzzy Sets and Systems, Vol 93(3), p.
293-299.

[10]Jimenez, F. and J.L. Verdegay, 1998. Uncertain solid transportation problem. Fuzzy Sets and Systems, 100(1-3), 45-57.

[11] Jimenez, F. and J.L. Verdegay, 1999. Solving fuzzy solid transportation problems by an evolutionary algorithm based parametric approach. European Journal of Operational Reseach, Vol 117(3), 485-510.

[12]Li, Y., K. Ida and M. Gen., 1997. Improved genetic algorithm for solving multiobjective solid transportation problem with fuzzy numbers. Computeurs & Industrial Engineering, Vol 33(3-4), p. 598-592.

[13]Michel Gourgand, Tuyet Hoa Pham, Alain Tanguy,Assignment planning transport problem with four indices,International Conference on Modeling, Optimization and SIMulation - MOSIM'12 06 to 08 June 2012 - Bordeaux - France.

[14] Nocedal, J., and S. J. Wright. Numerical Optimization ,1999 Springer-Verlag New York, Inc.

[15] Ninh, P.X., 1979. n index transportation problem. Mathematical Journal, Vol 7(1), 18-25, Vietnam.

[16] Ninh, P.X., 1980. Les problèmes de transport à plusieurs indices. Thèse de Doctorat, Institut Polytechnique de Hanoï, Vietnam.

[17]S.Molla-Alizadeh-ZavardehiaS.Sadi NezhadbR.Tavakkoli-MoghaddamcM.Solving a fuzzy fixed charge solid transportation problem by metaheuristics Mathematical and Computer Modelling March 2013, Pages 1543-1558

[18] Sharma, R.R.K. and S. Prasad, 2003. Obtaining a good primal solution to the incapacitated transportation problem. European Journal of Operational Research, Vol 144(3), p. 560-564.

[19] Sun, M., 2002. The transportation problem with exclusionary side constraints and two branch-and-bound algorithms. European Journal of Operational Research, Vol 140(3), p. 629-647.